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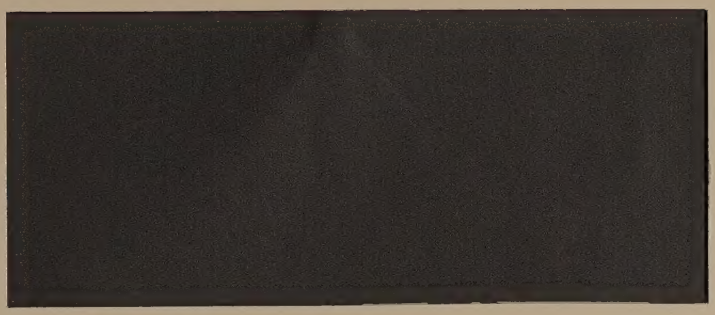


NESLAB

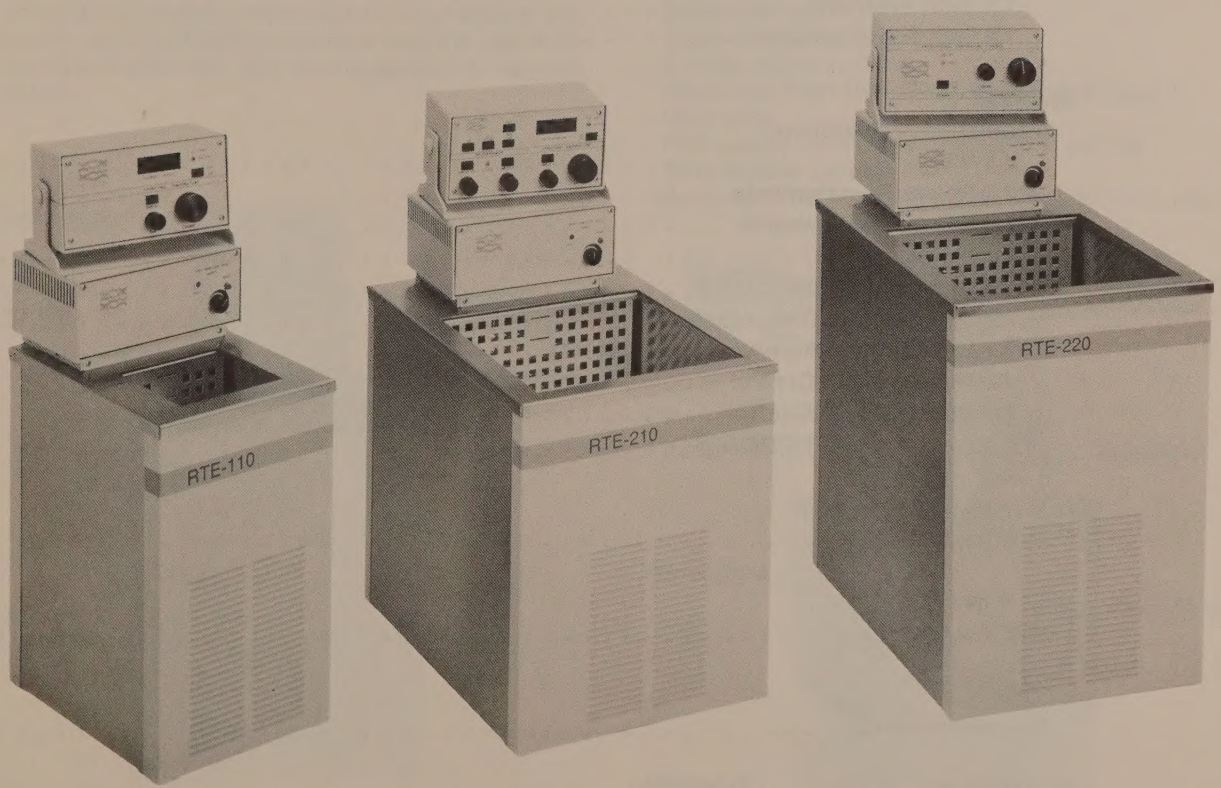
CONSTANT TEMPERATURE BATHS AND CIRCULATORS

IMMERSION COOLERS

REFRIGERATED RECIRCULATING HEAT EXCHANGERS

MP MASTER
MA32842

ENDOCAL RTE-SERIES
REFRIGERATED BATH
OPERATOR'S MANUAL



ENDOCAL RTE-SERIES REFRIGERATED BATH OPERATOR'S MANUAL

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SECTION I
GENERAL INFORMATION

1.1 UNPACKING

Each NESLAB unit is shipped in a sturdy, well supported cardboard carton. This attention to detail helps eliminate damages incurred in shipping. While unpacking, retain all cartons and packing material until the unit is operated and found to be in good condition. If the unit shows external or internal damage, or does not operate properly, contact the transportation company immediately and file a damage claim. Under ICC Regulations this is your responsibility.

1.2 CONTENTS

- Refrigerated Bath and Pump Housing
- Temperature Controller
- Stainless steel serrated hose connectors
- Thermometer (Analog only)
- Operator's Manual
- Warranty Card

1.3 WARRANTY

All NESLAB units are shipped with a warranty card. The top portion should remain with the unit. The bottom section must be filled out and returned to NESLAB. NESLAB Instruments warranties its units against defective parts and workmanship for one full year from the date of shipment. See back page for full warranty details.

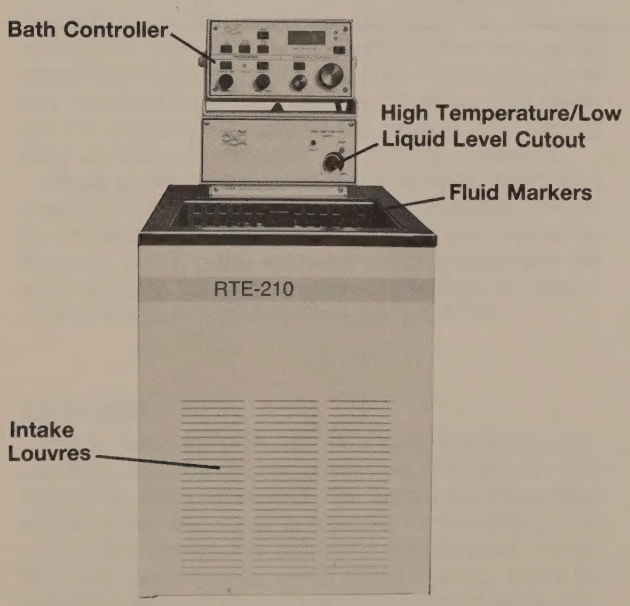
1.4 DESCRIPTION

The ENDOCAL series of benchtop refrigerated recirculators provide excellent temperature control for applications requiring refrigerated fluid work areas or pumping to external applications. These baths have been specifically designed to occupy a minimum amount of valuable bench space, and because of their hermetically sealed refrigeration system they can be relied upon for years of dependable, durable service.

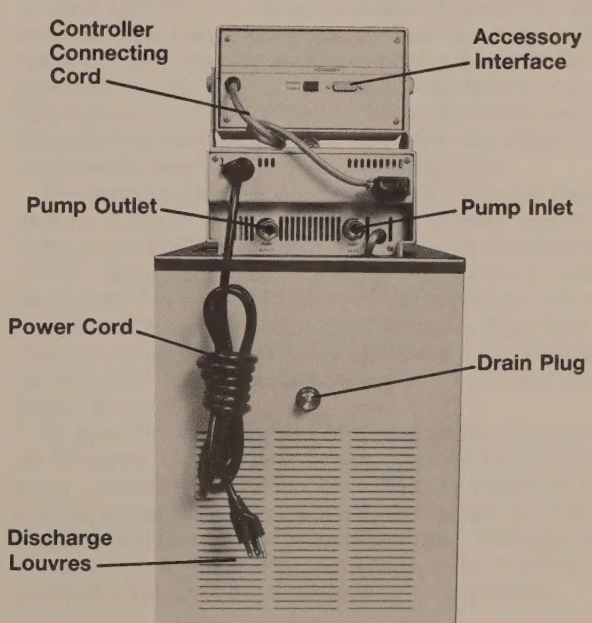
Each NESLAB bath is rigorously tested before leaving our factory. The procedure includes checking cooling capacity, pumping capacity, temperature stability and physical appearance. By paying attention to these details NESLAB is confident our baths will meet their advertised specifications.

1.5 BATH FEATURES

- Three temperature controllers
  Analog - Temperature range -30°C to 100°C
  Digital - Temperature range -30°C to 130°C
  Programmable - Temperature range -30°C to 130°C
- Detachable, tiltable, control boxes
- Stainless steel wetted parts
- Large bath work areas
- Automatic compressor shut-off
- Z pump (force/suction)
- Adjustable High Temperature/Low Level Cutout
- Drain plug
- High quality control components for precise temperature control
- Computer interfacable (Digital & Programming only)



Front View



Back View

1.6 UNIT SPECIFICATIONS

Model		RTE-110	RTE-210	RTE-220
TEMPERATURE RANGE	Analog Controller		-30°C to +100°C	
	Digital Controller		-30°C to +130°C	
	Programmable Controller		-30°C to +130°C	
TEMPERATURE STABILITY			@20°C ±0.01°C @60°C ±0.01°C	
COOLING* CAPACITY			500 watts at 20°C 300 watts at 0°C	
HEATER				
MAIN HEATER		800 watt	800 watt	800 watt
BOOST HEATER		N/A	N/A	850 watt
PUMPING* CAPACITY			0 - 12 L/min at 0' Head, Max. Head 17' (using water at 70°F)	
BATH AREA (LxWxD)	In.	5x5x5.75	10x10x5.75	10x10x9
	Cm.	12.7x12.7x14.6	25.4x25.4x14.6	25.4x25.4x22.8
FLUID DEPTH	In.	5.2	5.2	8.5
	Cm.	13.2	13.2	21.6
BATH VOLUME	Gal	1.3	3.2	5.3
	Liters	5.0	12.3	20.2
PHYSICAL DIMENSIONS (HxWxD)	In.	24⅝x8¾x12½	24⅝x12⅜x17¼	28x12⅜x17¼
	Cm.	62.6x22.2x31.75	62.6x31.5x43.8	71.1x31.5x43.8
POWER REQUIREMENTS	Volts	115 220/240	115 220/240	115 220/240
	Hz	60 50	60 50	60 50
	Amps	14 7	14 7	20 10
SHIPPING WEIGHT	Lbs.	77	80	83
	Kg.	35	37	38

* 60 HZ Models

SECTION II
INSTALLATION AND OPERATION

2.1 SITE

Proper location of an ENDOCAL refrigerated bath is essential for the unit to function properly. All ENDOCALS have air cooled refrigeration systems that require cool air to be drawn through the front of the unit and discharged as warm air out of the back. It is very important that the unit be placed where the air intake and discharge are not impeded. A minimum 12″ clearance is recommended between the wall and the back of the unit.

Lack of adequate cool air will cause a reduction in cooling capacity and/or complete shut down of the refrigeration compressor. Excessively dusty areas should be avoided, and the condenser should be cleaned periodically.

Ambient air conditions can also affect the bath's performance. The unit will maintain its full rated capacities in ambients of 50°F (10°C) to 80°F (27°C). Above 80°F (27°C) the RTE will lose 1% cooling capacity for every degree F° above 80°F (27° C), up to the maximum operating temperature of 90°F (32°C).

2.2 POWER REQUIREMENTS

Input Current Requirements

		RTE-110	RTE-210	RTE-220
Voltage	115 V 60 Hz	14 amps	14 amps	20 amps
	220 V 50 Hz	7 amps	7 amps	10 amps

2.3 FILLING REQUIREMENTS

Each ENDOCAL bath has a high and low level fluid marker to guide reservoir filling. The markers are 1″ horizontal slits located in the center of the stainless steel baffle that separates the refrigeration and pump assemblies from the bath area. The correct fluid level falls between these two markers. If correct fluid levels are not properly maintained the heating and cooling coils will become exposed and may be damaged.

When pumping to an external system, bath fluid levels must be maintained. Additional bath fluid should be on hand to top-off the reservoir as the circulating lines are filling. If the reservoir is left unattended the level will drop causing aeration of the fluid and exposure of the coils. NEVER RUN BATHS DRY!

2.4 FLUIDS

Fluids used in NESLAB ENDOCAL baths vary depending upon the desires of the user. The chosen fluid should be compatible with the bath's stainless steel wetted parts and never exceed 50 centistokes in viscosity throughout the operating temperature range. NESLAB recommends using distilled or tap water for operation above 8°C and a 50/50 mixture of laboratory grade ethylene glycol and water for operation below 8°C.

If silicone oil is chosen as a bath fluid, caution must be taken as follows. When filling the bath with silicone oil at room temperature, the bath should be filled to a depth of approximately 2″ below the low level marker. This will allow sufficient room for thermal expansion of most silicone oils. When heating the bath fluid, be sure the liquid level does not exceed the high level marker. If the reservoir level rises above this point before reaching the desired operating temperature, carefully remove a portion of the oil. Once the desired temperature has been reached oil can either be added or removed to reach the proper operating level.

The setpoint process will differ slightly from the procedure outlined in the temperature control section when using ENDOCAL baths with silicone oils above 115°C. Because silicone oil does not conduct heat away from the heater, the surface temperature of the heater tends to be much higher than the bath fluid. This may cause the bath's high temperature cutout to be activated if the setpoint is above 115°C and the heater is in full cycle.

To avoid this condition the following procedure must be followed. Set the bath temperature at 115°C and allow the bath to stabilize. Once the bath stabilizes at 115°C, adjust the temperature upwards two to three degrees and again allow to stabilize. Keep making the temperature adjustments upwards two to three degrees at a time, until the desired setpoint is achieved.

2.5 PLUMBING REQUIREMENTS

2.5.1 Hose Connections

The circulating pump inlet and outlet connections are recessed on the back of the pump housing. The inlet and outlet connections are 1/2" straight thread fittings. Each unit is supplied with two stainless steel serrated hose connections to accept 3/8" flexible tubing. All hose connections should be clamped for safety.

To achieve specified flow rates, avoid bending or kinking of circulating lines. Use of tubing smaller than 3/8" in diameter is not recommended and will cause significant deration of flow. If it is necessary to make a reduction in tubing size to fit external equipment the reduction should be made at the inlet port of the external equipment. The return line should also be increased back to 3/8" ID at the outlet of the external equipment.

Selection of the proper tubing is critical when operating at extreme high or low temperature. Improper tubing can become brittle and crack at low temperatures, or melt at very high temperatures. If silicone oil is used as a bath fluid, do not use a silicone based tubing to circulate. Likes dissolve likes and the tubing will become unsafe after prolonged circulation.

Insulating hose should be used whenever possible to enhance cooling capacities and temperature stability when circulating externally. Insulating hose will also eliminate sweating hoses.

2.5.2 Pump

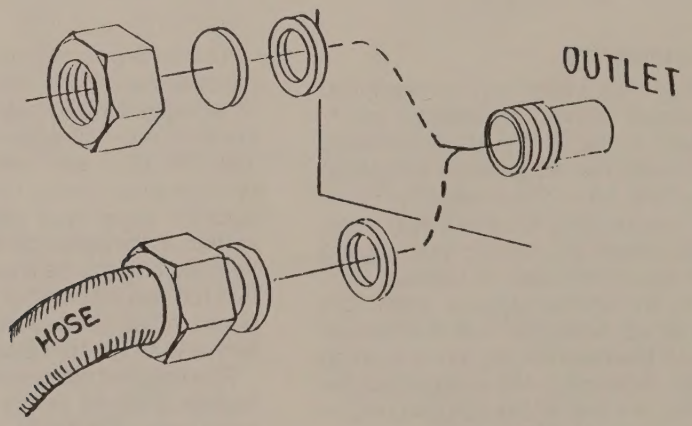
All ENDOCAL baths are equipped with a dual section (suction/force) recirculating pump. The unique design of this pump allows circulation to an open external container as well as through a closed loop.

2.5.3 Pumping

The circulating pump of an ENDOCAL bath is designed to deliver a flow of 12 liters/minute. To prevent any unwanted flow, the bath is supplied with two stainless steel discs, which block the pump inlet and outlet. When flow is required, the discs must be removed and replaced with the provided stainless steel serrated hose connections. To prevent leakage around the pump inlet and outlet be sure the two teflon O-rings remain in place. Once the hose connections are made, the pump must be properly plumbed to an external system. It is important that all plumbing work be done when the bath is not in operation.

If the bath is not being used for external circulation, and pump flow is blocked-off, the pump will vent itself and act as a stirrer. Again, it is important to have the stainless steel discs in place, or the tubing correctly plumbed, prior to operating the bath.

The circulating pump can also be used to add extra agitation to the bath reservoir. The extra stirring is achieved by connecting the pump inlet to the drain plug. The bath is stirred by the suction impeller. By opening the impeller into the drain, more liquid to thrown out into the bath, enhancing stirring.



2.5.4 Circulating to an Open Container

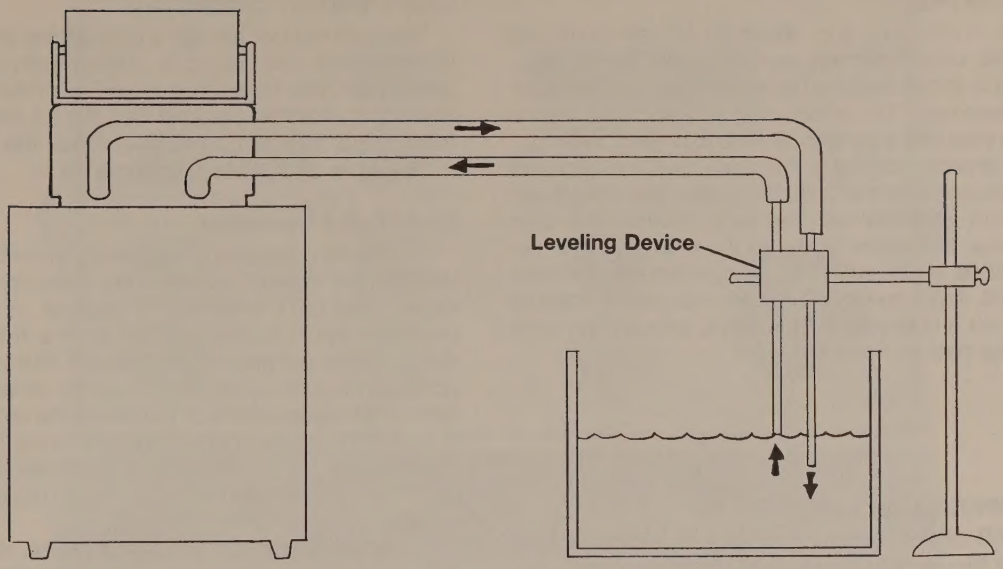
NESLAB will supply, upon request, a stainless steel leveling device to aid circulation to an open vessel. The leveling device should be supported in a position over the open container by means of a ringstand. It should be positioned so that the longer tube is submerged in the bath and the shorter tube is level with the bath fluid. When plumbing the bath to the leveling device, the pump outlet is attached to the longer tube while the inlet (suction) is attached to the shorter tube.

When the bath is turned on the outlet side will force fluid into the external vessel while the inlet (suction) will draw fluid back to the bath. The suction rate is not adjustable. Adjustment of flow must be made at the pump outlet to prevent the flow from exceeding the suction and draining the bath. Adjustment can be made with an accessory flow control valve, or by partially clamping the outlet tubing.

When properly adjusted, the suction pump will draw an occasional air bubble and prevent a possible overflow. The outlet side will be forcing fluid through the submerged tube and prevent aeration of the external bath.

To avoid siphoning, lift the leveling device out of the external bath and above the level of the ENDOCAL when the circulator is shut off.

Caution: Circulation to an open container is not recommended when using silicone oils at high temperature.

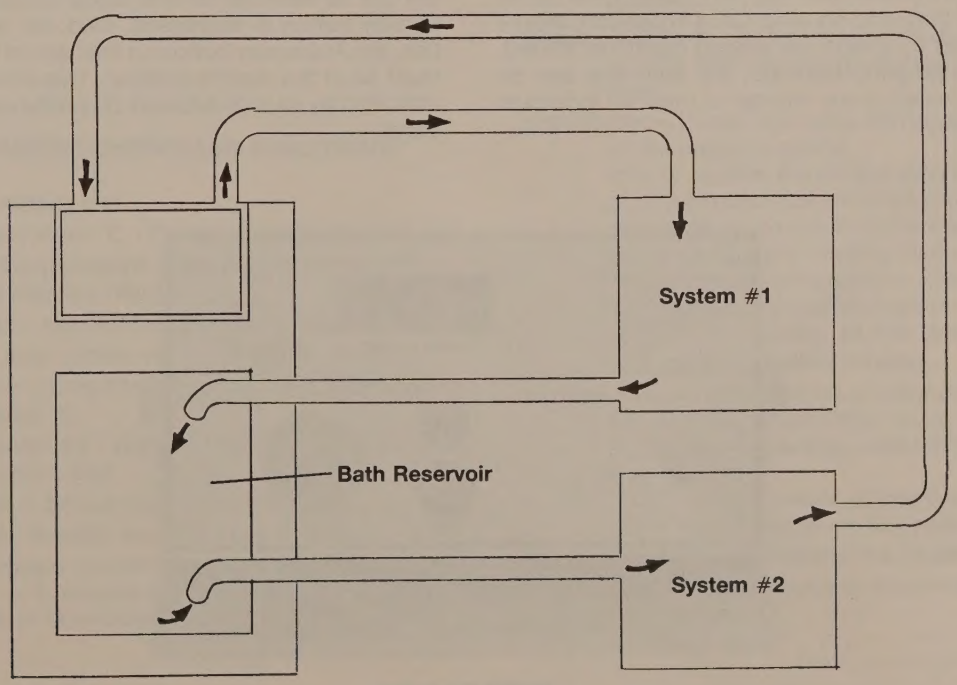


Circulating to an Open Container

2.5.5 Circulating Through Two Closed Loops

The ENDOCAL circulating pump can be used to circulate through two closed loop systems in the following manner. Connect the shortest possible section of flexible tubing from the pump outlet to the inlet of external system #1. Connect flexible tubing from system #1 outlet directly into the bath reservoir. Connect a section of tubing from the bath reservoir to the inlet of system #2. Connect a second section of tubing from the outlet of system #2 to the pump inlet.

The force section of the pump will push fluid through system #1 while the suction section of the pump will pull the fluid through system #2.



Circulating Through Two Closed Loops

2.5.6 Drain Plug

To aid in clean up and changing of bath fluids, all ENDOCAL circulators are equipped with drain plugs. The plug is located at the back of the unit at the base of the reservoir. The drain plug is equipped with a stainless steel disc and teflon O-Ring to prevent leaking.

When draining the bath, this plate must be removed and replaced with the stainless steel serrated hose connection supplied with the bath. Connection of a small piece of flexible tubing to the drain outlet is recommended to prevent fluid from running into the back of the unit. Any connection to the drain, either flexible tubing with a clamp or a flow valve, should be made before the bath is filled.

2.6 TEMPERATURE CONTROLLERS

NESLAB offers an Analog, Digital, or Programming controller for use with the ENDOCAL series of constant temperature baths. Each controller offers excellent temperature control and stability over a wide temperature range.

2.6.1 Control Box Mounting

Each bath is shipped as two components, the bath/pump housing assembly and the temperature controller. The controller can be mounted directly on the pump housing, or remote from the bath. NESLAB offers accessory lead cord lengths to suit most any remote controlling need. Also, wall mounting can be utilized at the remote location.

To mount the controller on top of the housing, locate the hole in the center of the controller bottom plate and position it on the mounting pin located in the center top plate of the pump housing. Once in position, secure the controller by sliding the locking clip firmly inward. After being properly fastened, the controller can be tilted or swiveled in any manner to meet an individual user's needs.

2.6.2 Controller Connections

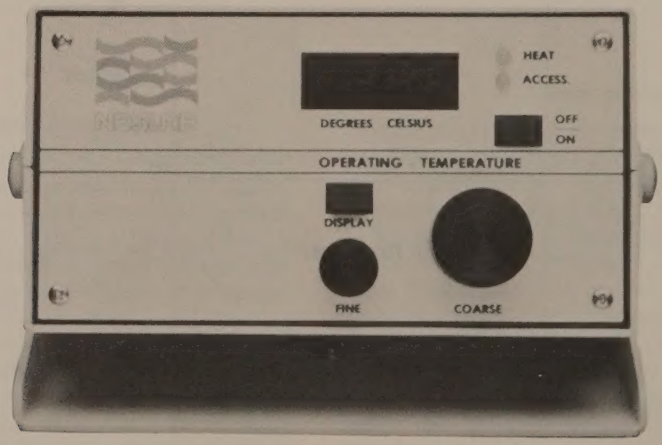
The bath will not accept a signal from the controller until the bath and controller components are properly connected. The 15 pin plug at the end of the controller's lead cord must be plugged into the 15 pin socket on the back of the pump housing. Once the connection is made the unit is ready for operation.

2.6.3 Digital Operation

The Digital controller is designed to combine precise temperature control and accurate setability with a convenient red LED temperature readout. A simple two position On/Off button located on the front panel of the controller will give the bath power. In the depressed position the unit is on and power is generated to all functional components of the bath. The red LED readout will light to indicate the controller is on. The temperature readout will indicate the actual bath temperature or, if the display button is depressed, the setpoint will appear.

To set an operating bath temperature, depress and hold the black spring loaded Display button. Turn the Coarse Control dial until the desired temperature setpoint is shown on the LED display. The Fine Control dial can be used to aid in accurate setting of the desired temperature. Once the operating temperature is set, release the Display button and the Display will read the actual bath temperature. As the bath approaches the set operating temperature the yellow LED Heat indicator will cycle on and off continuously signifying the bath has reached the setpoint. Small adjustments to the Fine control may be required to reach the actual setpoint temperature.

Inadvertent movement of the Coarse and Fine control dial, regardless of the position of the Display button, will result in a change of the setpoint. This change will not be reflected on the digital display unless the Display button is depressed. Also, for normal operation, the Accessory button on the back of the controller must be in the disable position. This condition will be indicated by an unlit Access LED on the controller front panel.



Digital Controller

Programming Controller

2.6.4 Programming Controller Description

The Programming controller combines the accuracy and convenience of a digital bath with the ability to perform linear temperature ramps. Advanced electronics assures a smooth linear ramp over various time and temperature combinations. The unit will function as a digital bath when the programmer is not in use.

PROGRAMMING CONTROLLER FUNCTIONS

On/off - Activates unit.

Time/Temperature °C - Provides digital readout

Operating Temperature - Reads bath temperature and setpoint Display °C

Coarse Dial - Adjusts operating bath setpoint.

Fine Dial - Aids coarse setting with fine control.

Programmer - Sets final temperature in program. Display °C

Final Temperature - Adjusts final temperature in program. Dial

Display Min. - Sets program time interval.

Period Dial - Adjusts program time interval.

1X/10X - Adjusts period time range:
1X = 5 minutes to 180 minutes
10X = 50 minutes to 1800 minutes

Run/Stop - Starts and stops program execution:
In run position, the period clock runs and temperature setpoint changes linearly from operating temperature to final temperature.
In stop position, the period clock stops and bath will hold its present value. When stop is released the program will continue on the same time interval.

Reset - Resets the programmer period clock and returns bath operating temperature to setpoint.

Hold/Return - Determines what will happen at the end of the program period:
In hold position the control setpoint will remain at final temperature when the program is completed. In return position, the control setpoint will return to the starting temperature upon completion of the program. The setpoint will change abruptly, but the bath temperature will respond as quickly, as the systems heating and cooling capacity allows.

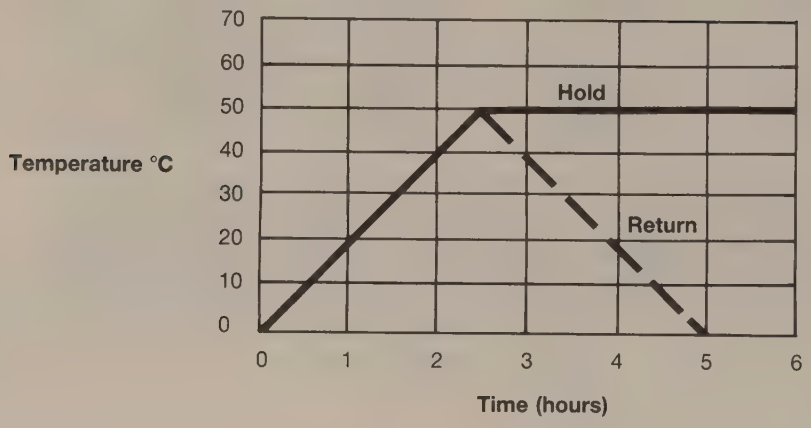
Status LED - Displays status of programmer clock:
If LED is off, programmer clock is stopped.
If LED flashes rapidly, programmer clock is running.
If LED flashes slowly, power has been turned off or interrupted since last reset.

Heat LED - Displays status of the heater.

Access LED - Displays status of Accessory switch on rear panel.

2.6.5. Mock Program

The following mock program will help illustrate the relationship between specific key functions, outlined in section 2.6.4, to an overall temperature program. This simple linear ramp will raise the bath temperature from 0°C to +50°C in a time span of 2.5 hours.



Step 1 - Activate unit and reset programmer clock

Unit is activated by depressing the two position On/Off button. Once engaged, the temperature readout will light and the yellow Status LED will flash slowly.

To reset the timer clock place the Run/Stop button in the stop position and momentarily depress the Reset button. The programmer clock will reset and the Status LED will go out, indicating the programmer is ready to accept a program.

Step 2 - Set starting temperature at 0°C

Depress the operating Display °C button and set the start temperature of the program to 0°C. For detailed instructions on setting the bath temperature refer to the Digital Controller section (2.6.3). While the bath temperature is stabilizing, set the remaining parameters of the program.

Step 3 - Set Final Temperature at 50°C

To set endpoint temperature depress the Programmer Display button and adjust the final temperature dial to 50°C.

Step 4 - Set Time Span

All time parameters associated with the programmer are interpreted in minutes. The time span of 2.5 hours translates to 150 minutes. To set the Time Function the 1X/10X button must be in the 1X position to interpret times between 5 and 180 minutes. Once in the correct time frame, depress the Display Minutes button and set the time to 150 minutes using the Period dial.

Step 5 - Set End Function

To hold the bath temperature at the final setpoint, set the Hold/Return button in the hold position.

Step 6 - Run

The program is ready to run once all parameters have been set and the bath temperature has stabilized at 0°C.

To initiate the run, simply release the Run/Stop button and the program will be executed. The Status LED will flash rapidly, indicating the program is being executed.

Programming Notes

Every linear curve must be designed with the bath's limitations in focus. No temperature or time parameters can exceed the performance capacities of the bath.

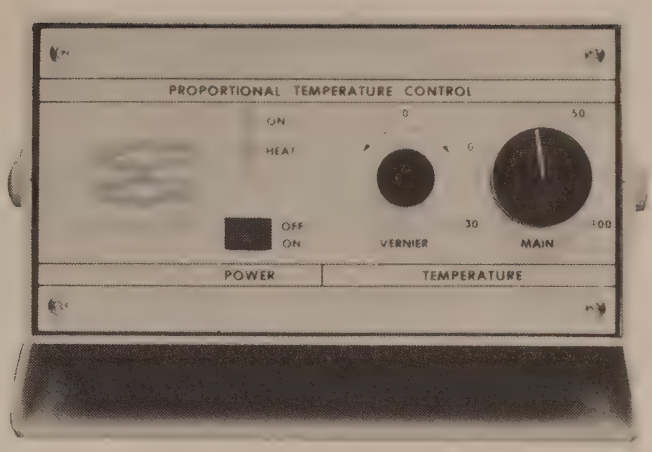
The programming ENDOCALS can function as a standard digital bath (outlined in section 2.6.3) by disengaging the programmer time clock. Once the bath is turned on, the yellow Status LED will flash slowly indicating that the controller has received power. Place the Run/Stop button in the Stop position and momentarily press the Reset button. This will reset the time clock and the LED will go out. The bath will now operate as a standard digital bath provided the Run/Stop button is in the Stop position.

2.6.6 Analog Operation

The Analog control system employs the latest in integrated circuit electronics and is designed for maximum reliability and operation simplicity. A simple two position On/Off button located on the front panel of the controller will give the bath power. In the depressed position the unit is on and power is generated to all the functional components of the bath. A yellow LED on the front panel will light to indicate this condition.

To adjust the bath temperature use the large calibrated Main dial, the small (+, -) Vernier dial and the bath thermometer. Position the main dial reference line as close to the desired bath temperature as possible. As the bath approaches the set operating temperature the yellow LED Heat indicator will cycle on and off continuously signifying a stabilized bath temperature.

Minor adjustments to the Vernier dial will produce a very precise bath temperature setting. Ultra fine temperature settings can be achieved with a finely calibrated external thermometer.



Analog Controller

2.7 HIGH TEMPERATURE/ LOW LIQUID LEVEL SAFETY

All NESLAB baths are equipped with an adjustable High Temperature/Low Liquid Safety. A single sensing probe is used to control both functions. The low end setting of the safety is 0°C, while the high end setting is 160°C.

The High Temperature/Low Liquid Level Safety should be set according to the following procedure:

Step 1

Locate the adjustment dial on the front panel of the pump housing and turn it clockwise to the 160°C setting.

Step 2

Turn the bath on, depress the Cutout Reset button, set the desired operating temperature, and allow the bath to stabilize.

Step 3

When the bath temperature has stabilized, turn the High Temperature/Low Level adjustment dial slowly counter clockwise until you hear a click. The bath will shut off and Red Fault LED will come on.

Step 4

Turn the adjustment dial clockwise, slightly above the mark where the unit cut out, and press the Reset button. The safety is now set to cut out a few degrees above your desired operating temperature. If the refrigeration system was on when the unit cut out, wait approximately 5 minutes before depressing the Reset button.

2.8 REFRIGERATION CONTROL

All NESLAB refrigerated baths are equipped with an automatic on/off control for the refrigeration compressor. The control is designed to protect the compressor from operation at high temperatures and to facilitate rapid temperature change over the bath's operating range.

The compressor will automatically activate if setpoint is 35°C or lower. However, if the bath temperature is 2°C cooler than the setpoint, the compressor will stop running while the bath heater cycles to maintain setpoint. To protect the bath refrigeration system from high temperature operation, the compressor will not operate at temperatures above 50°C.

2.9 BOOST HEATER CONTROL

The RTE-220 is equipped with an automatic boost heater. The boost heater is designed to provide additional heat to the unit's large fluid reservoir. Whether the heater is on or off depends upon the difference between the bath temperature and the setpoint.

1. If the bath temperature is within 2.5°C of the setpoint the boost heater remains off.
2. If the bath temperature is 2.5°C below the setpoint the boost heater will come on.

2.10 INTERFACING ENDOCALS

All NESLAB digital and programming baths can be remote controlled with various electronic accessories. This control is achieved by utilizing the 15 pin Accessory socket on the back of the controller. To activate the Accessory socket depress the two position Enable/ Disable button located next to the Accessory socket. When depressed the yellow LED labelled ACCESS will light. When no accessories are in use the button must be in the Disable position.

The digital and programming baths can also be controlled with a remote signal input of 10mV per degree Celsius. Contact NESLAB for more detailed programming instructions.

SECTION III
MAINTENANCE

CLEANING

It is recommended that the unit be drained and cleaned periodically. Wash with a mild soapy solution and dry with a soft clean cloth. DO NOT USE STEEL WOOL. Its abrasiveness will leave filings which initiate rusting.

ALGAE

NESLAB recommends the use of the algicide Chlorimin-T for protection against algae and bacteria build up. A rate of 0.2 - 0.3 grams/liter (1 gram/gallon) will be compatible with all NESLAB circulators. Contact NESLAB for further information and pricing.

RUST

Stainless steel will rust if not properly used and maintained. Any physical damage to stainless steel such as scratching or pitting will cause rusting. The stainless steel parts exposed to bath fluid should be thoroughly cleaned periodically.

SECTION IV
RTE ACCESSORIES

- Stainless Steel Flow Controller

Stainless steel ball valve that will attach to the pump outlet and allow flow regulation.

- Automatic Refill Device

Maintains bath liquid level by opening and closing a solenoid valve in response to changes in bath liquid levels.

- Overflow Device

Stainless steel stand pipe which attaches to the drain and prevents overflow of expanding fluid.

- Controller Extension Tether

Various size cable lengths for remote operation.

- Test Tube Rack

Custom fit test tube racks which utilize maximum bath area.

SECTION V
TROUBLESHOOTING

UNIT WILL NOT START

A. Check power source for correct voltage output.
B. Make sure the controller and bath connections are secured properly.
C. Check the High Temperature/Low Liquid Level safety located on the front of the pump housing.

LOSS OF COOLING CAPACITY

A. Be sure the cooling capacity of the RTE has not been exceeded if circulating to an external system.
B. If the RTE is shut off after the refrigeration compressor was operating, wait 5 minutes before restarting the unit. The refrigeration compressor will short cycle (clicking sound) if time is not allowed for equalization of refrigerant pressures.
C. The RTE needs proper ventilation for heat removal. Keep the front and rear ventilation panels open and cleared of dust. If ventilation is poor the refrigeration compressor will shut down because of heat build up.
D. Ice build up on the RTE cooling coil will act as insulation and lower cooling capacity of the unit. Raise the temperature of the bath to de-ice the cooling coil and increase the concentration of non-freezing solution.

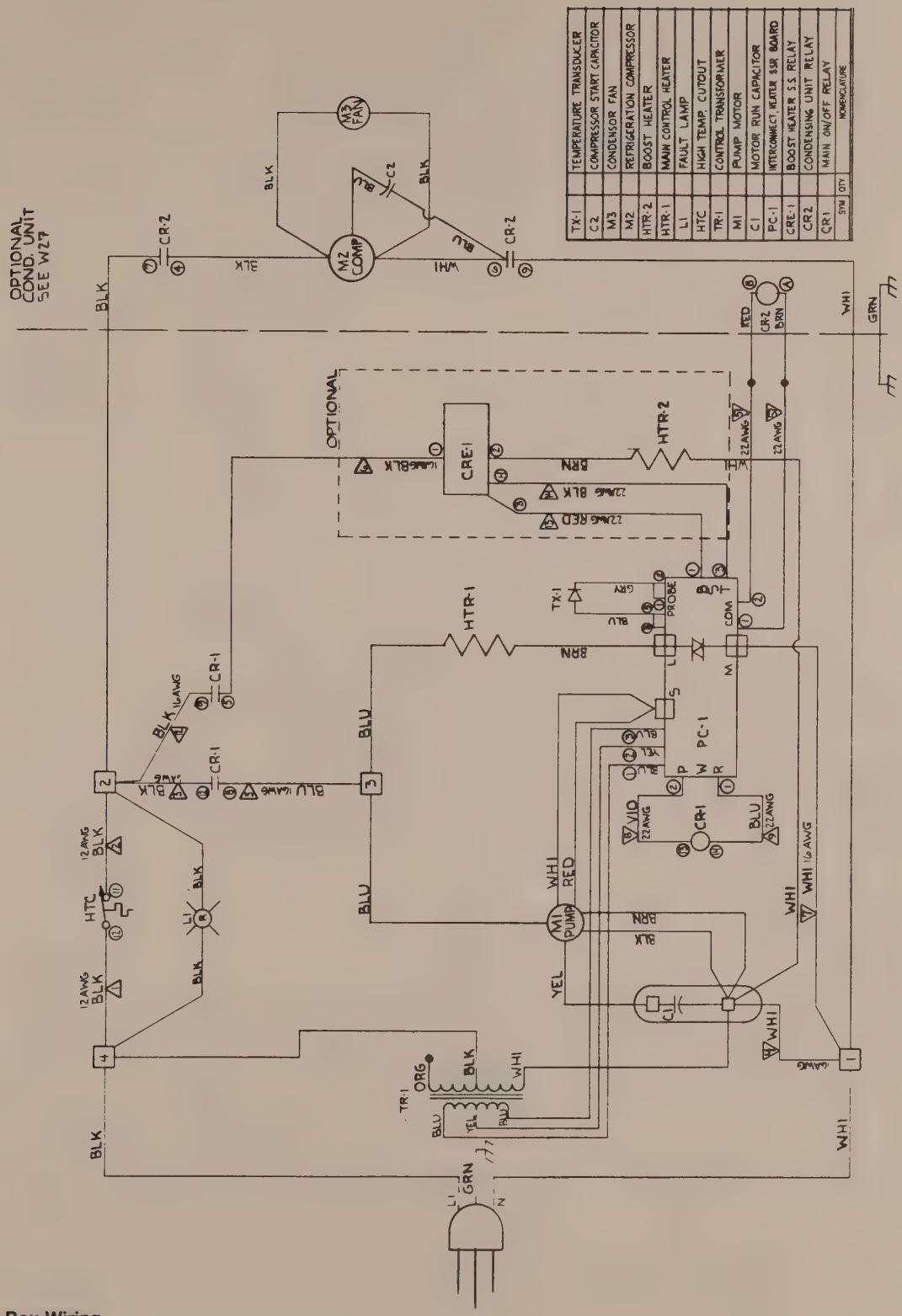
NO TEMPERATURE CONTROL

A. The accessory Enable/Disable button on the back of the controller must be in the correct position. If no accessories are in use the button must be in the Disable position, and Access LED will be off. If accessories are in use the button must be in the Enable position and the Access LED will be on.

NO EXTERNAL CIRCULATION

A. Make sure both the inlet and outlet pump plates have been removed.
B. Check for any blockage, kinks or leaks in the circulating lines.
C. Circulation will cease when the pump head has been exceeded. Review pump specification stated in section 1.6.

If your unit fails to operate properly after following these troubleshooting steps, contact our Instrument Service Department. When calling the Service Department please have the following information available: part number, serial number, voltage of the unit and your application.



Pump Box Wiring

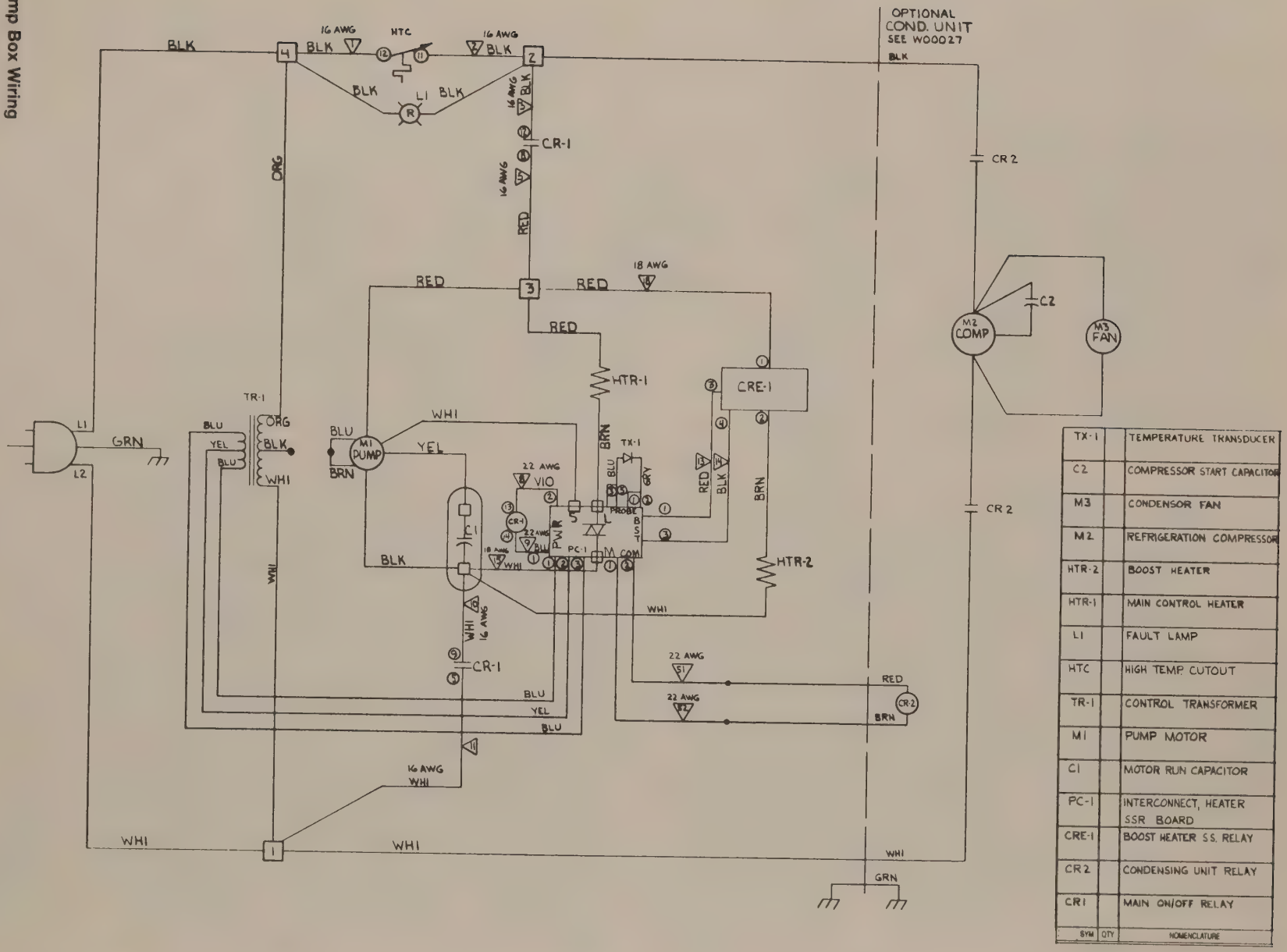
115 V 60 Hz

100 V 50/60 Hz

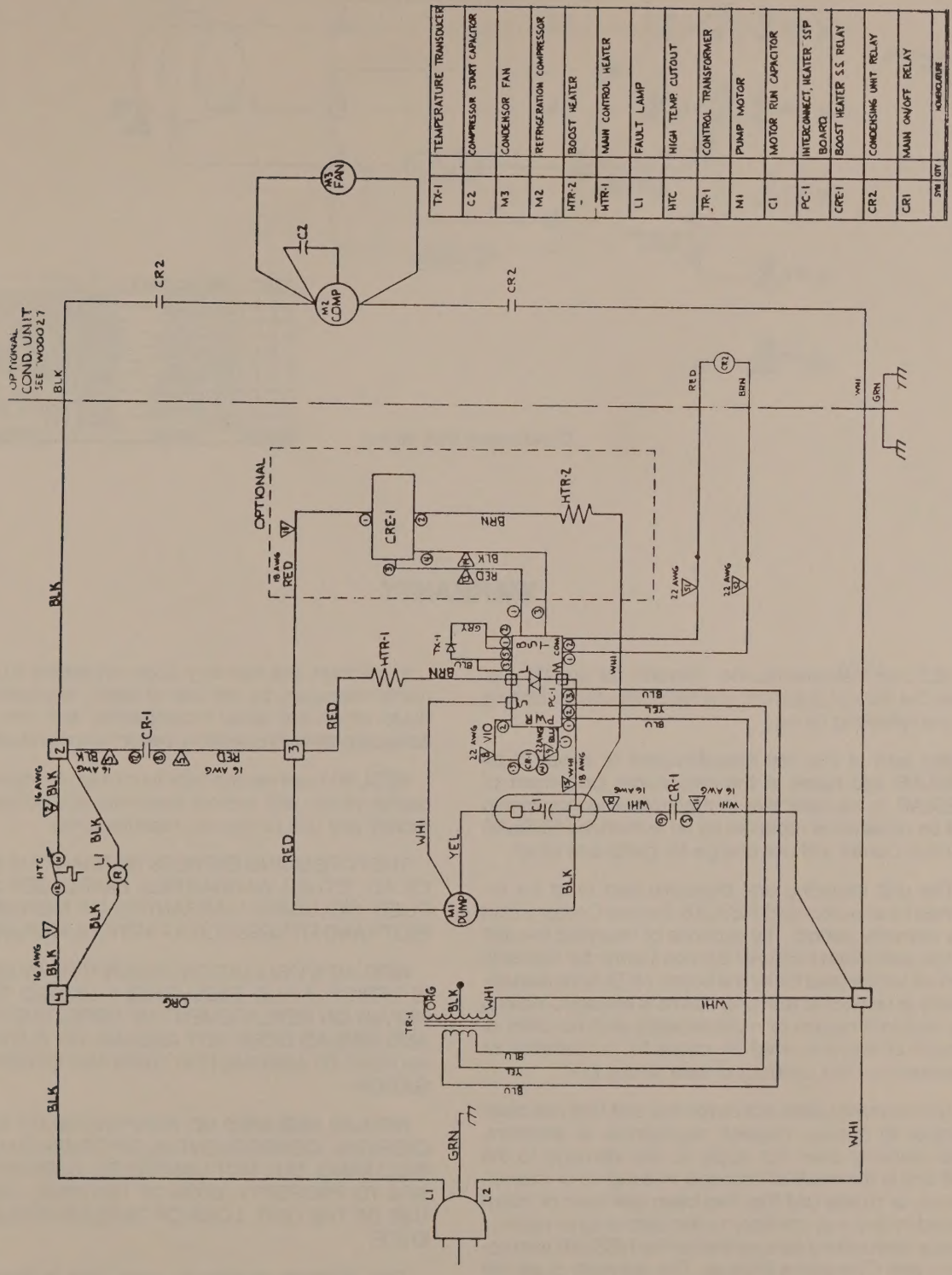
Pump Box Wiring

208/230 V 60 Hz

200 V 50/60 Hz

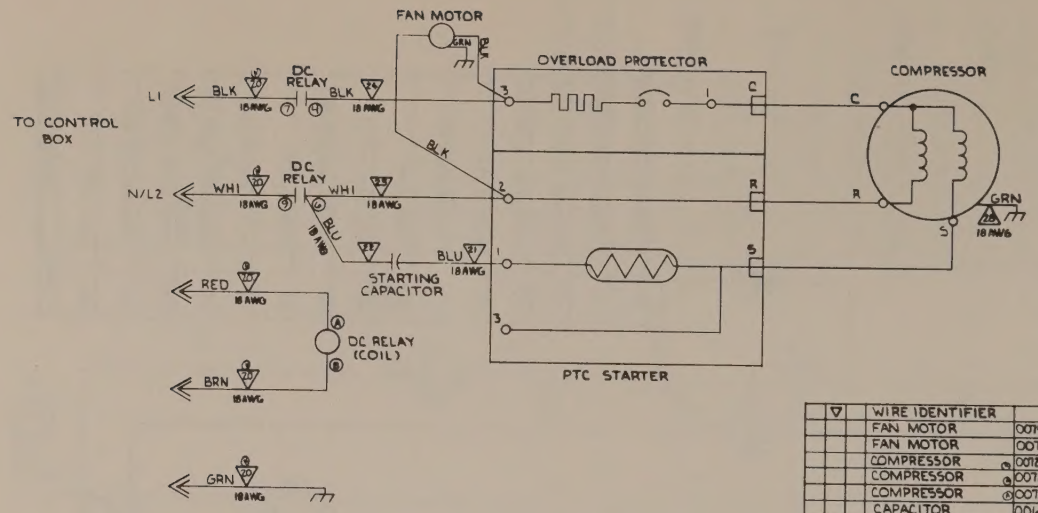


SYM	QTY	NOMENCLATURE
TX-1		TEMPERATURE TRANSDUCER
C2		COMPRESSOR START CAPACITOR
M3		CONDENSOR FAN
M2		REFRIGERATION COMPRESSOR
HTR-2		BOOST HEATER
HTR-1		MAIN CONTROL HEATER
L1		FAULT LAMP
HTC		HIGH TEMP CUTOUT
TR-1		CONTROL TRANSFORMER
M1		PUMP MOTOR
C1		MOTOR RUN CAPACITOR
PC-1		INTERCONNECT, HEATER SSR BOARD
CRE-1		BOOST HEATER SS. RELAY
CR2		CONDENSING UNIT RELAY
CR1		MAIN ON/OFF RELAY



Pump Box Wiring

200/240 V 50 Hz



Condensing Unit Wiring

			WIRE IDENTIFIER		
			FAN MOTOR	007401	100\115V 50\60Hz
			FAN MOTOR	007402	220\240V 50\60Hz
			COMPRESSOR	007263	100V 50Hz
			COMPRESSOR	007261	115V 60Hz
			COMPRESSOR	007262	220\240V 50\60Hz
			CAPACITOR	006175	ALL VOLTAGES
			PTC STARTER	006219	100V 50Hz
			PTC STARTER	006220	115V 60Hz
			PTC STARTER	006221	220\240V 50\60Hz
			RELAY	006173	12 VDC
ZONE	SYM	QTY	NOMENCLATURE	P/N	SPECIFICATION/VENDOR

WARRANTY

NESLAB Instruments, Inc. warrants for one (1) year from the date of shipment any NESLAB unit according to the following terms.

Any part of the unit manufactured or supplied by NESLAB and found in the reasonable judgement of NESLAB to be defective in material or workmanship will be repaired or replaced by an authorized NESLAB Service Center without charge for parts and labor.

The unit including any defective part must be returned to an authorized NESLAB Service Center within the warranty period. The expense of returning the unit to the authorized NESLAB Service Center for warranty service will be paid for by the buyer. NESLAB's responsibility in respect to warranty claims is limited to making the required repairs or replacements, and no claim of breach of warranty shall be cause for cancellation or rescission of the contract of sale of any unit.

This warranty does not cover any unit that has been subject to misuse, neglect, negligence, or accident. The warranty does not apply to any damage to the unit that is the result of improper installation or maintenance, or to any unit that has been operated or maintained in any way contrary to the operating or maintenance instructions as specified in the NESLAB Instructions and Operations Manual. The warranty does not cover any unit that has been altered or modified so as to change its intended use.

In addition, the warranty does not extend to repairs made necessary by the use of parts, accessories, or fluids which are either incompatible with the unit or adversely effect its operation, performance or durability.

NESLAB reserves the right to change or improve the design of any unit without assuming any obligation to modify any unit previously manufactured.

THE FOREGOING EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

NESLAB'S OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS, AND NESLAB DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR THEM ANY OTHER OBLIGATION.

NESLAB ASSUMES NO RESPONSIBILITY FOR INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OR DAMAGE TO PROPERTY, LOSS OF REVENUE, LOSS OF USE OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE.

This warranty applies to units sold in the United States. Any units sold elsewhere are warranted by the affiliated marketing company of NESLAB Instruments, Inc. This warranty and all matters arising pursuant of it shall be governed by the law of the State of New Hampshire, United States.

MP MASTER
MA32842

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